The science in the intelligent design debate: teach it like it is

Philip W. Bateman[a*] **and Jo Moran-Ellis**[b]

INTELLIGENT DESIGN, THE NEW INCARNATION of creationism, is appearing in schools and universities across the world. The stock response by scientists seems to be: 'It is not science'. What proponents of intelligent design and irreducible complexity have managed to do, however, is introduce enough of the scientific method into their arguments to make this stock response untenable. We argue that, in South Africa, students of biology are conflicted and confused over this issue and the reconciliation of their religious and scientific beliefs, and therefore need to learn about it in such a way that they are fully cognisant of what science and the scientific method is. In this way they can fully understand the weaknesses of the intelligent design position from a scientific point of view.

Intelligent design (ID) is 'creationism in a cheap tuxedo';[1] ID is 'creationism dressed in the robes of science';[2] ID is 'not science and is essentially religious'.[3] Such statements, issued primarily by scientists, are intended, we assume, to end the debate between the two ontological positions which attempt to explain the diversity of life on this planet. The debate has not ended, of course, and it runs the risk of polarizing into two unassailable camps when such unequivocal statements are used. Here, we argue that it is the ID camp that has made the boldest moves to take the battle to the evolutionists. They have done so in direct response to such assertive statements on the nature of science and ID. In doing so they have strengthened their ideological standing but they have also exposed their theory to counter attacks based on the scientific standing of their theory.

How would we define science? This question, when presented to zoology Honours classes in South Africa, as often as not, results in hesitant suggestions as to 'truth', 'facts', or 'experimentation'. If we were to agree that science, as understood in the natural sciences, is about competing hypotheses that can be tested, falsified, examined and re-examined, then evolutionary theory would fall within this definition of science. We then should ask whether ID can be considered science, or whether valid arguments exist which make it pseudo-science. One argument often put forward to demarcate ID from science relates to the teleology supposedly inherent in the phrase 'intelligent design'. This logically supposes the existence of an 'intelligent designer', usually perceived as 'divine'.

Proponents of ID (ID-ers), however, claim not necessarily to mean an Abrahamic god as Creator when they invoke ID. In fact, they need claim no 'divine' prime mover in creation (*sensu* St Thomas Aquinas's first and second proofs of God in *Summa Theologiae*), just a mover that 'designed' and that this 'designer' *may* be perfectly natural. Steven Meyer, of the Discovery Institute (www.discovery.org) and one of the architects of ID, says 'intelligent design is not a religious-based idea, but instead an evidence-based scientific theory about life's origins—one that challenges strictly materialistic views of evolution.'[4] This argument smacks of dissimulation in that ID *is* the ideological child of creationism and those ID-ers who are vocal on the subject *are* theists. For example, Phillip E. Johnson, regarded as the father of ID, says 'my personal view is that I identify the designer of life with the God of the Bible, although intelligent design does not entail that.'[5] Johnson also mentions the 'famed atheist philosopher Anthony Flew',[5] who, in 2004, apparently converted to theism due to scientific evidence. Flew said: 'I think that the most impressive arguments for God's existence are those supported by recent scientific discoveries',[6] by which he meant intelligent design and 'more than fifty years of DNA research'.[6] Johnson even avers: 'although as yet Flew does not adhere to Christianity or any other creedal faith, he has taken a giant step in that direction.'[5] This implies that acceptance of a supernatural god is the intent of ID, rather than a weak, philosophical, non-revelatory deism (which is what Flew really appears to be supporting) or, say, the inference of an extraterrestrial bio-engineer, which would just push a naturalistic explanation of evolution onto another planet.[7]

It could, therefore, be argued that this dislocation of 'god' from the ID argument is merely tactical. Berger[8] even opines that the deliberate injections of science and empiricism into creationism through ID are not serious but 'designed to sow doubt and confusion amongst those not well acquainted with the methods and results of scientific research.'[8] This may be true, but it is important to realize that just because there is a theological agenda behind the ID movement, by removing the divine (albeit speciously) from the argument the ID-ers become successful in promoting their agenda. Justice Antonin Scalia[9,10] successfully defended the teaching of creation/ID alongside evolution against the charge of being unconstitutional, due to the religious implications of the creation/ID argument, by citing 'irrelevancy of intent'. His theoretical example: if a professor teaches in class that the Roman Empire was not present in Palestine at the time of Christ, against all the historical and archaeological facts, the implication is that the Crucifixion story is *wrong*. Christians would therefore complain for theological reasons. There is religious motivation in the complaint, but here is a case where it would clearly *not* be unconstitutional to order the professor to teach otherwise. An example like this shows that a theological reason for an argument *need not* rely on theological precepts; 'natural' precepts *can* support a theological agenda and be independent of it.

ID-ers have been very successful in capitalizing on this argument. They have, to a much greater extent than before, been able to divorce the divine endpoint of ID from their argument by embracing 'irreducible complexity'. As with ID, irreducible complexity does not *need* a divine creator, it merely requires a designer; a specious argument perhaps, but effective. A book-length argument by the biochemist Michael Behe for the existence of irreducible complexity appeared in 1996.[11] The now-notorious illustrative example of irreducible complexity that he used was that of a mouse trap. A mouse trap needs a platform, a spring, a catch, and a bar that is released to kill the mouse. All four separate elements are interdependent: take away any one element of the trap and you have a pile of junk useless for its purpose. The trap therefore is irreducibly complex.

> By irreducible complexity I mean a single system which is composed of several interacting parts that contribute to the basic function, and where the removal of any one of the parts causes the system to effec-

[a]Department of Zoology and Entomology, University of Pretoria, Pretoria 0002, South Africa.
[b]Department of Sociology, University of Surrey, Guildford, Surrey, GU2 7XH, U.K.
*Author for correspondence.
E-mail: bill.bateman@zoology.up.ac.za

> tively cease functioning. An irreducibly complex system cannot be produced gradually by slight, successive modifications of a precursor system, since any precursor to an irreducibly complex system is by definition non-functional.[11]

This simple example has been expanded by Behe and others, particularly William Dembski in his book *The Design Inference* in 1998.[12] Purported examples of irreducible complexity that will be familiar to most who have followed this debate are the chemical cascade resulting in blood clotting, and the complex internal workings of bacterial flagella.[4,11–15]

Irreducible complexity is effectively William Paley's watchmaker argument in his *Natural Theology* of 1802[16] (in turn, Paley's argument is an expansion of Aquinas's fifth proof of God, which is that of evidence of intelligent design so it is an argument that has been around in written form since at least the 13th century), which states that just as a complex watch found upon a heath would indicate a watch maker, living organisms express such complexity that 'natural' processes cannot explain them: they must be the result of a designer—God. What irreducible complexity does for the ID movement, however, is provide a scientific way to divorce the divine from the debate even further than does ID. It does this by concentrating on the premise that natural processes (evolution and its prime explicator, natural selection) are insufficient to explain the diversity of form and function of life which bespeak design, whatever the designer may be.

But here is our major point: *irreducible complexity fulfils the requirements of being science.* It relies on empirical, historical and experimental evidence to support its stance. For example, the evolutionist Kenneth Miller, arguing against irreducible complexity, claimed that to test its validity one could, through molecular genetics, 'wipe out an existing multiple-part system and then see if evolution can come to the rescue with a system to replace it.' Miller then describes an experiment that shows this, and concludes that Behe is wrong.[17] That is a fine example of the scientific method. Behe disagreed with Miller's example, but he also (with some glee, we would imagine) pointed out that Miller had shown how irreducible complexity could be tested empirically and potentially falsified.[18] Behe has also said that, 'despite much general progress by science in the past half century in understanding how complex biochemical systems work, little progress has been made in explaining how such systems arise in a Darwinian fashion.'[19] In addition he stated that, 'the Darwinian mechanism does not look like it can produce what it claims to be able to produce.',[20] and that 'the idea of common descent has some support, and also some problems. Right now, I am willing to accept it as a reasonable working hypothesis, but I could always change my mind.'[20] It is difficult to dismiss these viewpoints as 'non-scientific', even if one disagrees with them. The last quote is pretty much unassailable, certainly if one accepts the precepts of the scientific method.

There is an important corollary to this: if we accept the arguments above as being scientific, and thus accept the challenge of ID-ers to argue their viewpoint scientifically, then we move away from sterile, unequivocal assertions. If one's viewpoint is that evolution is the best explanation for biological diversity and function, as we assume is the case for most biologists, ID and irreducible complexity are highly unlikely to persuade one otherwise. Most importantly, however, ID would fail as a scientific theory not because of philosophical arguments about divine teleology, *but simply because it fails to find support through irreducible complexity or any other scientific design inference.* Most biologists would fail to be convinced by purported examples of irreducible complexity. There is not space to discuss these examples but a huge compilation of arguments against the science of irreducible complexity can be accessed online at 'Behe's Empty Box'.[21] By insisting that ID and irreducible complexity are scientific, ID-ers will have their arguments challenged scientifically and will have them found wanting.[21] In reviewing Behe's book, the evolutionary geneticist H. Allan Orr sums up this position beautifully: 'the latest attack on evolution *is cleverly argued, biologically informed—and wrong*' (emphasis added).[22] It is this viewpoint that we feel we should embrace when teaching evolution. Yes, the scientific method relies on falsifiability[23] (and one should remember that Karl Popper, the father of falsificationism, took some convincing that evolution *was* falsifiable), and it relies on empirical testing of data. Apply this to the hypotheses of ID and irreducible complexity and neither proves to be robust or reliable, while evolution and natural selection continue to prove so (although, of course, they may fail to do so at some time).

Why is this important? One of us (P.W.B.) asked a third-year B.Sc. class of 13 students a series of questions about the evolution/ID debate and found that, while there was general acceptance of evolution (86% of the class agreed that 'the diversity of species on earth today is the result of the process of evolution', and 69% disagreed with the statement that 'a belief in evolution is incompatible with a belief in God'), 61% of the class agreed with a final statement referring obliquely to irreducible complexity: 'complex structures such as the eye can be brought about by evolution'. When irreducible complexity was discussed, many students who had never heard of it before found it revelatory and became very interested. For many, even zoologists, conflicted over the religion/evolution dualism, irreducible complexity may be a clincher for religion.

Evans[24] summarizes the ontogeny of evolutionary understanding in children as spontaneous generation of species at 6–8 years, creationism at 8–10 years and creationism or evolution at 10–12 years. Dempster and Hugo[25] cite Moore *et al.*,[26] who show that first-year university students in South Africa are also at this last stage, but with a Lamarckian rather than a Darwinian bent to their understanding of evolution. The cognitive processes to understand/adopt an evolutionary standpoint appear to be achieved only by 10–12 years,[24] and may stay undeveloped at that level for several years.[26] Dempster and Hugo[25] make a strong case for teaching a wide, historically-based, detailed approach to natural selection-driven evolution due to its undoubted importance as the unifying empirical explanation of biology.[27,28] Dobzhansky[29] sums it up by stating that 'nothing in biology makes sense except in the light of evolution'.

We agree with Dempster and Hugo.[25] Our experience with students suggests, however, that, at third-year and Honours-level zoology, ID and irreducible complexity also should be taught and discussed and dissected. One does not need to support it; in fact, as we have indicated above, once ID and irreducible complexity are discussed scientifically, there is no support for them. They become a non-argument that is merely a counterpoint to examining and testing evolutionary theory. Students, however, need to come to this position (if they do) formally; denying the science of ID and particularly of irreducible complexity ultimately does damage to the scientific standing of evolutionary theory. Universities need, perhaps, to consider the introduction of courses on the history and philosophy of science at an earlier stage than Honours (if they even do that), so that defining science, and the whole paradigm of the scientific method into which they have, apparently unwittingly, bought, is not a

difficult question resulting in blank stares and halting answers from students in their fourth year of study.

The philosopher of science, Thomas Kuhn, believed that science goes through a series of paradigm shifts[30] and the revolutionary before becoming orthodox. If the ID debate is entered into by the evolutionary biologists in the same way as do the ID-ers, then ID is found not to be reliable or robust.[21] This, with simple philosophy, is what we need to teach.

We thank the students of the Zoology & Entomology Department: those who filled in the questionnaire and those who have entered into discussions and debates about intelligent design, evolution and science with vigour, interest and occasional fury.

1. Melott A.L. (2002). Intelligent design is creationism in a cheap tuxedo. *Physics Today,* June 2002. Online: http://www.aip.org/pt/vol-55/iss-6/p48a.html
2. University of Warwick podcasts. Intelligent Design or Evolution – Professor Steve Fuller and Professor Jack Cohen Episode. Online: http://www.podcastdirectory.com/podshows/339033
3. Kitzmiller *et al.* vs Dover Area School Board. Online: http://www.pamd.uscourts.gov/kitzmiller/kitzmiller_342.pdf
4. Meyer S.A. (2006). Signs of Intelligence. An originator of ID makes a case for weighing the theory about how we got here on its scientific merits. *Dallas Morning News,* January 29, 2006. Online: http://www.discovery.org/scripts/viewDB/index.php?command=view&id=3189
5. Johnson P.E. (2007). Intelligent design prospects in biology: the current situation and future prospects. *Think* (The Royal Institute of Philosophy) February 19, 2007. Online: http://www.discovery.org/scripts/viewDB/index.php?command=view&id=3914&program=DI%20Main%20Page%20%20Article&callingPage=discoMainPage
6. Flew A. and Habermas G.R. (2004). My pilgrimage from atheism to theism. An exclusive interview with former British atheist Professor Anthony Flew. *Philosophia Christi.* Online: http://www.biola.edu/antonyflew/index.cfm
7. Shermer M. (2005). God & Evolution: Intelligent Design Theory, George W. Bush & the Question of God. *eSkeptic.* Online: http://www.skeptic.com/eskeptic/05-08-16.html
8. Berger M. (2006). The clash of cultures in the classroom and the teaching of evolution. *S. Afr. J. Sci.* **102**, 90.
9. Edwards vs Aguillard. Online: http://www.talkorigins.org/faqs/edwards-v-aguillard/amicus1.html
10. Shermer M. (1997). Science defended, science defined. Evolution and Creationism at the Supreme Court. In *Why People Believe Weird Things: Pseudoscience, Superstition, and Other Confusions of our Time,* pp. 154–172. W.H. Freeman, New York.
11. Behe M. (1996). *Darwin's Black Box: The Biochemical Challenge to Evolution.* The Free Press, New York.
12. Dembski W.A. (1998). *The Design Inference: Eliminating Chance through Small Probabilities.* Cambridge Studies in Probability, Induction and Decision Theory. Cambridge University Press, Cambridge.
13. Meyer S.C. (2004). The origin of biological information and the higher taxonomic categories. *Proc. Biol. Soc. Wash.* **17**, 213-239. Online: http://www.discovery.org/scripts/viewDB/index.php?command=view&id=2177
14. Meyer S.C. (2005). The letter *Nature* wouldn't print. Online: http://www.discovery.org/scripts/viewDB/index.php?command=view&id=2565
15. Meyer S.C. (2005). Not by chance: from bacterial propulsion systems to human DNA, evidence of intelligent design is everywhere. *National Post of Canada,* December 1, 2005. Online: http://www.discovery.org/scripts/viewDB/index.php?command=view&id=3059
16. Paley W. (1802). *Natural Theology: Evidences of the Existence and Attributes of the Deity Collected from the Appearances of Nature.* Oxford University Press, Oxford.
17. Miller K.R. (1999). *Finding Darwin's God: a Scientist's Search for Common Ground Between God and* Evolution. Cliff Street Books, New York.
18. Behe M. (2000). A true acid test: Response to Ken Miller. Online: http://www.arn.org/docs/behe/mb_trueacidtest.htm
19. Behe M. (2007). Home page, Dept. of Biological Sciences, Lehigh University. Online: http://www.lehigh.edu/~inbios/faculty/behe.html
20. Wieland C. (1998). The mousetrap man. Interview with Mike Behe, the mousetrap man *Creation* **20** (3), 17 June. Online: http://www.answersingenesis.org/creation/v20/i3/mousetrap.asp
21. Behe's Empty Box: Book reviews and criticisms. Online: http://www.simonyi.ox.ac.uk/dawkins/WorldOfDawkins-archive/Catalano/box/behe.shtml#reviews
22. Orr H.A. (1996). Darwin v. Intelligent Design (again). *Boston Review* December 1996/ January 1997. Online: http://bostonreview.net/BR21.6/orr.html
23. Popper K.R. (1959). *The Logic of Scientific Discovery.* Routledge, London.
24. Evans E.M. (2000). The emergence of beliefs about the origins of species in school-age children. *Merrill-Palmer Quarterly* **46**, 221–254.
25. Dempster E.R. and Hugo W. (2006). Introducing the concept of evolution into South African schools. *S. Afr. J. Sci.* **102**, 106–112.
26. Moore R., Mitchell G., Bally R., Inglis M., Day J. and Jacobs D. (2000). Undergraduates' understanding of evolution: ascription of agency as a problem for student learning. *J. Biol. Educ.* **36**, 65–71.
27. Dennett D.C. (1995). *Darwin's Dangerous Idea: Evolution and the meanings of life.* Simon & Schuster, New York.
28. Dawkins R. (2006). *The God Delusion.* Bantam Books, U.K.
29. Dobzhansky T. (1973). Nothing in biology makes sense except in the light of evolution. *The American Biology Teacher* **35**, 125–129.
30. Kuhn T.S. (1962). *The Structure of Scientific Revolutions.* University of Chicago Press, Chicago.